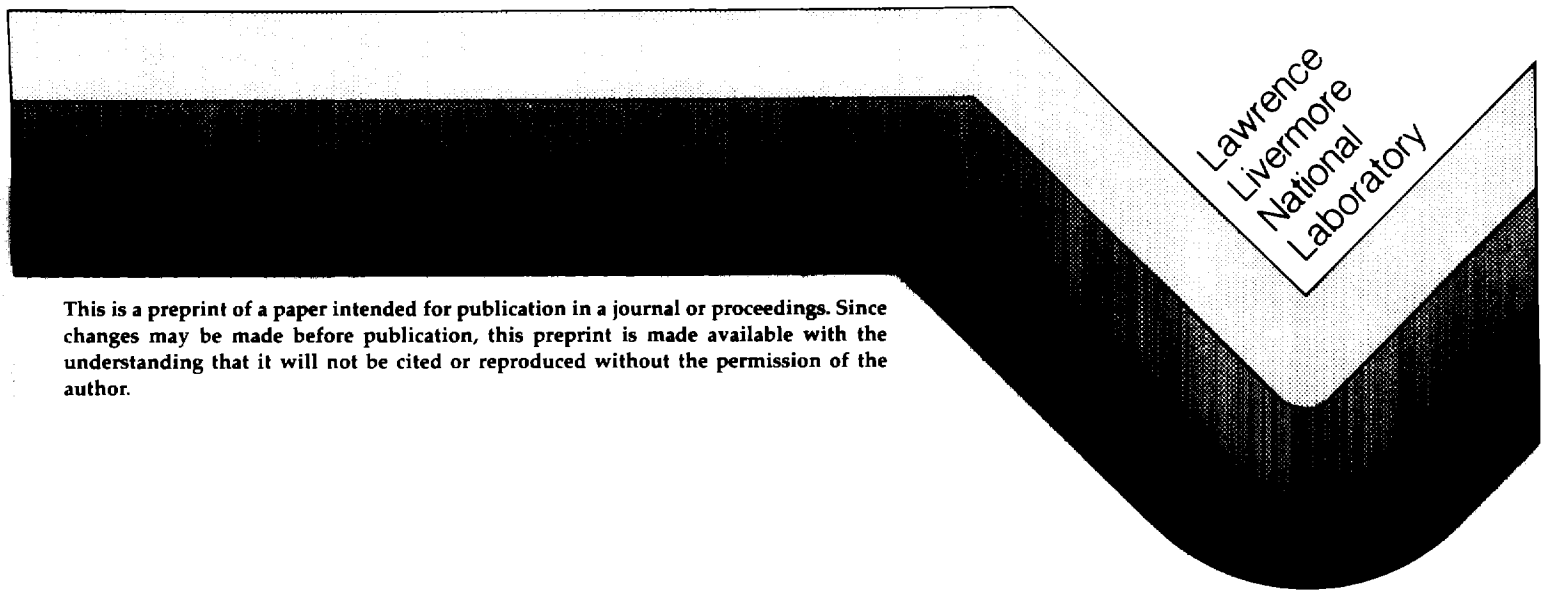
UCRL- 94485
PREPRINT

THE Be-Rh (BERYLLIUM-RHODIUM) SYSTEM

H. Okamoto
L. E. Tanner

This paper was prepared for submittal to
Bulletin of Alloy Phase Diagrams

April 18, 1986



The Be-Rh (Beryllium-Rhodium) System
9.01218 102.9055

By H. Okamoto and L.E. Tanner
Lawrence Livermore National Laboratory

Equilibrium Diagram

Three intermediate phases, (1) $Be_{0.6}Rh$ (13.2 at.% Rh) [70Joh] or $Be_{17}Rh_2$ (10.5 at.% Rh) [71Ver], (2) Be_2Rh [36Mis], and (3) BeRh [68Kru], have been found in this system. No other phase diagram data are available.

The melting point of βBe and the βBe --> αBe allotropic transformation temperature are 1289±4 and 1270±6 °C, respectively [86BAP]. [50Kau] observed a eutectic network in a slowly cooled alloy containing 1 at.% Rh. Hence, the solubility of Rh in (αBe) is probably much less than 1 at.%. The melting point of Rh is 1963 °C [81BAP].

Crystal Structures

A summary of crystal structure and lattice parameter data is given in Table 1. $Be_{0.6}Rh$ [70Joh] and $Be_{17}Rh_2$ [71Ver] were reported to have nearly identical lattice size but differing hexagonal forms; both are derivative of the $CaCu_5$ prototype. The non-integer formula, $Be_{0.6}Rh$, is due to a partial occupancy of lattice sites [70Joh]. The results of studies on single crystals [70Joh] are preferred in Table 1 to those from studies on powder specimens [71Ver].

The CsCl-type structure of BeRh reported by [68Kru] was consistently explained by [80Tan] from the study of a series of Be-transition metal systems.

Acknowledgments

Be-Rh evaluation contributed by **L.E. Tanner**, L-217, Lawrence Livermore **National** Laboratory, P.O. Box 808, Livermore, CA 94550 and **H. Okamoto**, B77G, Lawrence Berkeley Laboratory, Berkeley, CA 94720. Work was supported by the U.S. Department of Energy under contract no. W-7405-Eng-48 and American Society for Metals (ASM). Literature searched through 1984. Part of the bibliographic search was provided by ASM. L.E. Tanner and H. Okamoto are ASM/NBS Data Program Category Editors for binary beryllium alloys.

Table 1 Be-Rh Crystal Structure and Lattice Parameter Data

Phase	Composition, at.% Rh	Pearson symbol	Strukturbericht designation	Space group	Prototype	Lattice parameters, nm a	c	Reference
(βBe)	0	cI2	A2	Im3m	W	0.25515	...	[82Kin]
(αBe)	0	hP2	A3	$P6_3/mmc$	Mg	0.22857	0.35839	[81Kin]
$Be_{6.6}Rh$	13.2	(hexagonal)	(a)	$P\bar{6}m2$	...	0.4191	1.0886	[70Joh]
$Be_{17}Rh_2$	10.5	(hexagonal)	(b)	P6/mm	...	0.4203	1.090	[71Ver]
Be_2Rh	33.3	(c)	?	?	?	?	?	[36Mis]
BeRh	50	cP2	B2	Pm3m	CsCl	0.27397	...	[68Kru]
(Rh)	100	cF4	A1	Fm3m	Cu	0.38032	...	[81Kin]

(a) Closely related to the $CaCu_5$ ($D2_d$) type [70Joh].
(b) Th_2Zn_{17} or $Ni_{17}Th_2$ type. (c) Complex. Similar to Be_2Ir [36Mis]. Anisotropic [68Kru].

Cited References

*36Mis: L. Misch, "Crystal Structures of Some Beryllium Alloys," Metallwirtschaft, 15(6), 163-166 (1936) in German. (Equi Diagram, Crys Structure; Experimental)

50Kau: A.R. Kaufmann, P. Gordon, and D.W. Lillie, "The Metallurgy of Beryllium," Trans. ASM, 42, 785-844 (1950). (Equi Diagram; Experimental)

*68Kru: A.A. Kruglykh, N.N. Matyushenko, and G.P, Tikhinsky, "Crystalline Phases of the System Rhodium-Beryllium. I. Rh Monoberyllide," Ukr. Fiz. Zh., 13, 1107-1110 (1968) in Russian. (Equi Diagram, Crys Structure; Experimental)

*70Joh: Q. Johnson, G.S. Smith, O.H. Krikorian, D.E. Sands, "Crystal Structure of $RhBe_{\approx 6}$," Acta Crystallogr., B26(2), 109-113 (1970). (Equi Diagram, Crys Structure; Experimental)

*71Ver: L.F. Verkhorobin, "Beryllides of Ruthenium, Osmium, Rhodium and Iridium of Composition M_2Be_{17}," Izv. Akad. Nauk SSSR, Met., (6), 168-171 (1971); TR: Russ. Met., (6), 121-122 (1971). (Equi Diagram, Crys Structure; Experimental)

80Tan: L.E. Tanner, "The Stable and Metastable Phase Relations in the Hf-Be Alloy System," Acta Metall., 28(12), 1805-1816 (1980). (Equi Diagram; Theory)

81BAP: "Melting Points of the Elements", Bull. Alloy Phase Diagrams, 2(1), 145-146 (1981). (Equi Diagram; Compilation)

81Kin: H.W. King, "Crystal Structures of the Elements at 25 °C", Bull. Alloy Phase Diagrams, 2(3), 401-402 (1981). (Crys Structure; Compilation)

82Kin: H.W. King, "Temperature-Dependent Allotropic Structures of the Elements", Bull. Alloy Phase Diagrams, 3(2), 275-276 (1982). (Crys Structure; Compilation)

86BAP: to be published in Bull. Alloy Phase Diagrams, (1986)

* Indicates key paper.